INNOVATING THE FEDERAL ACQUISITION PROCESS THROUGH INTELLIGENT AGENTS

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Information technology (IT) developments are helping to improve many processes — defense acquisition being one of them. One acquisition reform initiative is to increase efficiency through leveraging standardized IT applications such as the Standard Procurement System (SPS). Benefits to date have been only marginal, however — one reason being that their implementation was accomplished without first redesigning the existing inefficient process. This article examines opportunities for innovation in the federal acquisition process, focusing specifically on intelligent agent (IA) technologies that offer potential for order-of-magnitude gains in terms of performance.

The nature of work is shifting dramatically in the information age, and the structure of modern organizations must shift even further in order to accommodate this quantum change (Nissen, 1999b). Most enterprises — including government agencies — are actively involved with IT-focused process redesign (Bashein, Markus, & Riley, 1994), including acquisition, which is central to supply-chain management. Although IT is used to support and streamline many clerical and administrative tasks along the supply chain, the key intellectual activities of such "knowledge work" have been resistant to process innovation (Davenport, 1995). In fact, recent case studies of "high-performance" procurement organizations (cf. Nissen, 1997) continue to reveal a huge reliance on manual, paper-based, labor-intensive processes.

IT collaboration tools are becoming available in the marketplace, but most acquisition professionals still rely heavily on the telephone (and e-mail) to coordinate procurement activities (Gebauer, Beam, & Segev, 1998). Some intelligent information-finding agents (e.g., "bots") are being implemented to identify potential trading partners and supply sources, but these simple agents are limited. They are incapable of automating all the necessary steps required for dramatically improved supply-chain performance. This inefficient, people-based practice is no longer appropriate for the dynamics,

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complexity, and criticality of supply-chain management today (Nissen, 1999b).

Rapid advancements in IA technology offer tremendous potential for automating these kinds of supply-chain activities. And government acquisition represents an ideal candidate for using IAs for innovation because of its high cost and long development times. Indeed, IA technology shows its greatest potential for automating activities associated with knowledge and information (Nissen, 2001), with which acquisition processes are replete. By accomplishing such automation, the acquisition professional can perform more value-added tasks, such as managing relationships and making key decisions. In addition, quantum decreases in process cost and cycle time (e.g., as measured by procurement action leadtime) are possible through IA technology.

> "Rapid advancements in IA technology offer tremendous potential for automating these kinds of supply-chain activities."

This article examines opportunities for making the federal acquisition process more innovative using IAs and proposes future applications. It is divided into three sections. We already have provided an introduction into acquisition and IT innovation arenas. The section that follows gives a brief background of federal acquisition and focuses specifically on the SPS. This background is followed by an overview of IA technology, which represents the primary enabler of acquisition process innovation discussed subsequently. The article summarizes the specific work of Fowler (1999), which builds upon the framework and specific findings from McCarthy (1998). Both of these works use a tailored innovation process based on Davenport (1993), which is augmented by Nissen (1996a) for IA applications.

The second section details the innovation process that combines Davenport's innovation model with Fowler's four-step IA assessment method. The concluding section presents a summary of findings and areas for further research.

STANDARD PROCUREMENT SYSTEM

Federal contracting has made considerable progress in the information age. For instance, in 1995, the Department of Defense (DoD) acquired the SPS to implement a comprehensive plan designed to standardize all procurement functions (Malishenko, 1999). As of April 2000, nearly 20,000 SPS users are supported at 702 sites worldwide (O'Hara, 2000). Providing integrated support for many activities on the buyer side of DoD supply chains, the SPS is essentially workflow technology (White & Fischer, 1994) adapted for military acquisition, and it is designed to interface with legacy systems as well as with other current technology.

Although the SPS has good acquisition applications, criticisms include its sizable cost and inflexible design — it attempts to meet the government's unrealistic goal to standardize and automate a system that is neither standard nor suitable yet for widespread automation (Fowler, 1999). Other noteworthy problems include negligible cost improvement, lack of systems integration, incomplete functionality, inadequate training and computer-hardware budgets, and resistance to change in contracting organizations (McCarthy, 1998).

Nonetheless, the SPS represents a significant step forward in contracting technology, and its implementation promotes development of the kind of IT infrastructure required to support the more advanced and powerful electronic contracting technologies (Nissen, 1999b). IA technology represents one advanced and powerful class of electronic contracting technology that is emerging from the artificial intelligence laboratories; laboratory prototypes exist today using intelligent acquisition agents that offer order-of-magnitude gains in process performance (e.g., cost, cycle time; cf. Mehra & Nissen, 1998).

INTELLIGENT AGENT TECHNOLOGY

A brief overview of IA technology is presented here. Agents function within intelligence, collaboration and mobility dimensions, as depicted in Figure 1. Central to the power and potential of agent technology is that it combines (artificial) intelligence (such as expert systems), collaborative capability (such as parallel processing systems) *and* network mobility (remote programming applications). Intelligent acquisition agents (IAAs) are notionally plotted in the middle of the three-dimensional space of Figure 1 to depict this novel, powerful, combined capability. It helps to group agents into four classes: informative filtering, information retrieval, advisory, and performative (Nissen, 2001). IAAs are best classified as performative agents, as they perform useful acquisition work and can autonomously execute binding commercial transactions on behalf of diverse users (Nissen, 2001). However, they also subsume capabilities of other agent classes. For example, they have been designed to exhibit behaviors such as information filtering and retrieval, and they can be used

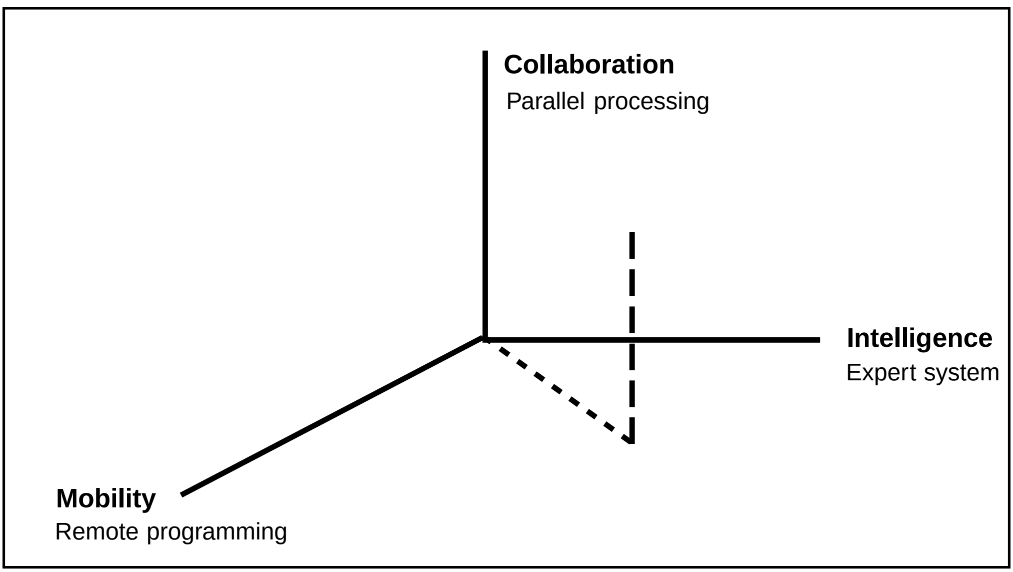

Figure 1. Agent Framework

for advisory supply-chain support (e.g., recommending purchase items, best-value suppliers; cf. Gilbert et. al., 1995; Nissen & Mehra, 1998).

ACQUISITION PROCESS INNOVATION

With this background, innovation begins here with consideration of the Federal Acquisition Process (FAP). The FAP is the academic model for the government's standard acquisition process. This represents the baseline for our research, and it is based on the required documents specified in the Federal Acquisition Regulation (FAR) Part 7 (1990). It is a comprehensive representation of all the activities of government acquisition, broken down into 85 functions, as shown in the adjacent box ("The Federal Acquisition Process" [1998]), which include many functions not delineated in FAR Part 7. (See Figure 2.)

Although IA technology appears to offer considerable promise across the gamut of acquisition environments, it is impossible to investigate them all in a single study such as this. We limit this analysis to commercial, competitive (i.e., non-sealed bid), product-based acquisitions between the micro-purchase threshold (i.e., $2,500) and major system (e.g., ACAT I) level. With this, seven of the 85 FAP functions (i.e., services, processing bids, bid acceptance periods, late offers, price analysis of sealed bids, responsiveness, and noncommercial remedies) fall outside the scope of research reported in this article, and so we limit our analysis to the remaining 78 FAP activities. Nonetheless, this still addresses a majority of the more common and SPS-capable applications.

Using the FAP for baseline analysis, this research builds upon prior work (e.g., McCarthy, 1998) by using Davenport's framework for process innovation (Davenport, 1993). We augment this framework through application of Knowledge-based Organizational Process Redesign (KOPeR) model, a Web-based expert system that analyzes processes for innovation opportunities and recommends redesign transformations (Nissen, 1998). And we draw directly from Fowler (1999) to employ his four-step method for assessing the potential of IA opportunities.

THE INNOVATION PROCESS

In this second major section, we begin with Davenport's call to develop a new process vision (Davenport, 1990). Discussion then turns to an assessment of various IA technologies' potential to innovate within the FAP, followed by the logic behind a prototype of the new (redesigned) process.

DEVELOP NEW PROCESS VISION

With the FAP defined as a baseline for analysis, we employ KOPeR to diagnose a number of serious pathologies afflicting this acquisition process. KOPeR has demonstrated its efficacy in terms of diagnosing process pathologies and recommending enabling technologies and other organizational transformations required for process innovation (cf. Nissen, 1999a). Critical among the set of pathologies diagnosed by KOPeR is the manual, paper-based, labor-intensive, regulation-driven manner in which FAP activities are currently performed. Although the SPS effectively addresses some problems in

FAP FUNCTION	FAP FUNCTION
Phase I. Acquisition Planning **A. Determination of Need** 1. Forecasting Requirements 2. Acquisition Planning 3. Purchase Requests 4. Funding 5. Market Research **B. Analysis of Requirement** 6. Requirements Documents 7. Use of Government Property/Supply Sources 8. Services **C. Extent of Competition** 9. Required Sources 10. Competition Requirements, Unsolicited Proposals 11. Set-Asides 12. 8(a) Procurements **D. Source Selection Planning** 13. Lease Versus Purchase 14. Price-Related Factors 15. Nonprice Factors 16. Method of Procurement or Purchasing **E. Solicitation Terms & Conditions** 17. Contract Types, Pricing Arrangements 18. Recurring Requirements 19. Unpriced Contracts 20. Contract Financing 21. Need for Bonds 22. Method of Payment 23. Procurement Planning **Phase II. Contract Formation** **F. Solicitation of Offers** 24. Publicizing Proposed Contract Actions 25. Oral Solicitation 26. Solicitation Preparation 27. Pre-Award Inquiries 28. Prebid/Prequote/Preproposal Conferences 29. Amending/Canceling Solicitations **G. Bid Evaluation** 30. Processing Bids 31. Bid Acceptance Periods 32. Late Offers 33. Price Analysis, Sealed Bidding 34. Responsiveness **H. Proposal Evaluation** 35. Processing Proposals 36. Applying Nonprice Factors 37. Price Analysis, Negotiations 38. Pricing Information from Offerors 39. Audits 40. Cost Analysis 41. Evaluating Other Offered Terms/Conditions 42. Award without Discussions	43. Communications, Fact-finding 44. Extent of Discussions (Competitive Range) 45. Negotiation Strategy 46. Conducting Discussions and Negotiations **I. Contract Award** 47. Debriefing 48. Responsibility 49. Subcontracting Requirements 50. Prepare Awards 51. Issue Awards and Notices 52. Mistakes in Offers 53. Protests **Phase III. Contract Administration** **J. Initiation of Work and Modification** 54. Contract Administration Planning 55. Post-Award Orientations 56. Consent to Subcontracts 57. Subcontracting Requirements 58. Contract Modifications 59. Options 60. Task and Delivery Order Contracting **K. Quality Assurance** 61. Monitoring, Inspection, and Acceptance 62. Delays 63. Stop Work 64. Commercial and Simplified Acquisition Remedies 65. Noncommercial Remedies 66. Documenting Past Performance **L. Payment & Accounting** 67. Invoices 68. Assignment of Claims 69. Administering Securities 70. Administering Financing Terms 71. Unallowable Costs 72. Payment of Indirect Costs 73. Limitation of Costs 74. Price and Fee Adjustments 75. Collecting Contractor Debts 76. Accounting and Estimating Systems 77. Cost Accounting Standards 78. Defective Pricing **M. Special Terms** 79. Property Administration 80. Intellectual Property 81. Administering Socio-economic and Miscellaneous Terms **N. Contract Closeout or Termination** 82. Claims 83. Termination 84. Closeout 85. Fraud and Exclusion

Figure 2. The Federal Acquisition Process

terms of manual work and paper-based communications, its workflow technology provides only a partial cure for the myriad, serious FAP ills. Indeed, the SPS treats the symptom and not the problem (McCarthy, 1998), in that it is a classic example of a common management fallacy to force automation on a system instead of improving it. As Hammer advises us, we are "paving the cow-paths" when our reengineering simply automates an inefficient process rather than obliterating it (Hammer, 1990). Alternatively, drawing from Fowler (1999), we outline a rich vision of efficient, paperless acquisition processes. Key elements of this vision are summarized in the adjacent box ("Key Elements of the New Process Vision") (Fowler, 1999).

This vision can be enabled through incorporation of two IA-technology elements into the FAP. First, the acquisition professional can employ IA applications to conduct a majority of the redundant, clerical, and programmable acquisition functions. Such internal agents would perform tasks within the acquisition shop's network of computers (e.g., in conjunction with the SPS). Second, external performative agents would conduct functions outside the local network. For example, multiple data-mining functions with numerous shared data warehouse (SDW) systems — such as material

- Automate acquisition functions to free personnel to focus on more value-added functions.
- Link supply, purchasing, contracting and customer offices into a comprehensive, one-stop virtual acquisition entity.
- Allow customers to obtain real-time, on-line data for transactions.
- Infuse the seamless use of the Internet to all customers.
- Increase the access by using flexible and mobile entry points.
- Establish a security system commensurate with the users' authority and subject matter classification.
- Provide a comprehensive, secure, and auditable digital "paper trail" for all transactions.
- Add virtual support and training to provide needed education and technical problem solving.
- Ensure that all procedures, forms, and reports are standard and that data are easily shared.
- Accommodate as many external systems with dissimilar IT infrastructures as possible.

Figure 3. Key Elements of the New Process Vision

visibility systems, past performance, award history and open contracts databases, legal activities, contractor's publications, market banks, electronic catalogs, industry standards, the Commerce Business Daily (CBD), and various other related business opportunity pages and electronic postings — can be performed and used by IAs. And this technology may hold particular promise in terms of market surveys, preparing and analyzing requests for proposals (RFPs) and requests for quotations (RFQs), and even recommending best-value sources for selection (Nissen & Mehra, 1998).

Although IA technology offers considerable promise to enable this new process vision, parts of the technology are maturing at different rates. And not all FAP activities appear to offer equal potential for IA automation and support at the present time. Thus, we assess IA potential in the context of 78 specific FAP activities.

ASSESS IA POTENTIAL

Fowler (1999) further describes a four-step approach to assessing IA potential:

- Identify functions performed well at present by current systems (especially the SPS).
- Identify strong potential benefits based on IA research.
- Evaluate feasibility based on current IA technology.
- Consider risks associated with implementation into acquisition processes.

The authors leverage their combined experience with federal and commercial acquisition, knowledge of IT and IA technologies, and in-depth use and analysis of the SPS. Assessing the potential of IAs to automate and support the FAP is a key element of this article. Each assessment step is addressed in turn.

Step 1: Assess SPS functionality. The functionality of the SPS is assessed with respect to the FAP in this first step. In particular, the assessment focuses on the degree to which the SPS automates each FAP activity at present. To reflect this assessment, each FAP activity is scored with a "minus" grade where strong SPS automation support exists. A zero is assigned where SPS automation capabilities are undetermined or neutral, and a "plus" grade denotes that the SPS does not currently automate the corresponding tasks.

> "Although IA technology offers considerable promise to enable this new process vision, parts of the technology are maturing at different rates."

Clearly, we do not wish to focus IA development on FAP activities that are already supported well by the SPS. Here are some examples. FAP function 3, Purchase Requests, receives a minus grade, because the SPS does a comprehensive job automating the formation of those requests. On the other hand, FAP function 5, Market Research, receives a plus grade, because the SPS does not automate and perform market research. The SPS can manually process and incorporate market research data only if the user specifically manipulates the data.

To summarize results of this first step, a minus grade is assessed for 15 of the 78 functions of the FAP. In general, as with FAP function 3 above, these functions pertain to acquisition document formation and management actions that the SPS performs well. Again, our objective is to complement the SPS, not compete against or be redundant with its capabilities. Contractual information is sequentially formed as the SPS user progressively inputs data, to include functions that are predominantly repetitive and routine in nature. Appropriate information is pulled from the originating document, like a purchase request, and automatically placed into the correct format to the next document, like RFQs.

> "Again, our objective is not to focus development on process activities that do not show good promise in terms of IA automation."

Forty-one FAP functions are graded zero. The SPS does not fully automate the majority of these steps, because they rely upon personal intuition and experience from the upper-level user to process. But the SPS indirectly facilitates and supports these acquisition functions, and future releases of the SPS may eventually support them fully. Therefore, they represent only marginal candidates for IA automation.

The remaining 22 functions receive a plus grade here in Step 1. In general, the SPSs do not perform these functions, because they require more personal interaction and are more complex, such as negotiations and oral solicitations. Therefore, at this first stage of analysis, these 22 functions represent the best candidates for IA development, as they offer promise to fill a void in SPS functionality.

Step 2: Assess IA potential. The potential of IA technology is assessed with respect to the FAP in this second step. In particular, the assessment focuses on the degree to which current IA research suggests each FAP activity offers good potential to be automated. To summarize results of this second step, each FAP activity is assessed with a minus grade where weak IA automation potential is evident. A zero is assigned where IA automation capabilities are undetermined or neutral, and a plus is assigned where IA research offers good promise to automate the corresponding tasks. Clearly, we do not wish to focus IA development on FAP activities that are not considered promising in terms of current research.

As examples, two functions — FAP function 5, Market Research, and FAP function 9, Required Sources — pose great potential for improvement using this type of innovation, so they are graded with a plus. Alternatively, others such as FAP function 19, Unpriced Contracts, are graded with a minus. FAP function 3, Purchase Requests, receives a zero, because it falls in between these two levels in terms of IA potential. Note that the grades assigned in this step are independent of those assigned in Step 1 above.

In this second step, IA technology is graded with a minus for 15 of the 78 functions of the FAP. In general, these functions pertain to highly cognitive, complex or analytical functions — those that stretch the limits of extant agent technology. Again, our objective is not to focus development on process activities that do not show good promise in terms of IA automation. In particular, recall the four classes of IAs from above that reflect current research in this field. We would thus envision IA technology as particularly appropriate for information filtering and retrieval, advisory roles, and performative functions.

Forty-five FAP functions are graded zero. IA technology does not suggest high potential for automation of the corresponding FAP steps, because they fall outside most current research focuses and developments. However, some IA research is directed toward such activities. Therefore, they represent marginal candidates for IA automation. Finally, the remaining 18 functions receive a plus grade. In general, IAs perform these functions well, and they are currently being demonstrated in the laboratory or commercial application. Therefore, at this stage of analysis, these 18 functions represent the best candidates for IA development.

With this, we now combine the results produced in Steps 1 and 2 of the analysis, as we narrow our focus to those FAP activities having some promise. Specifically, after adding the Step 1 and Step 2 scores, only those activities with a total grade of a zero or higher (from a range of double minus to double plus) are considered for further agent potential. This reduces the candidate set of FAP activities to 62; that is, 16 of the 78 FAP activities assessed in Steps 1 and 2 are eliminated from consideration in Steps 3 and 4 (because they have grades of double-minus or minus) in terms of IA potential. Such focus can help the SPS and IA developers concentrate their efforts on automating high-payoff acquisition activities that can be addressed in the near term.

Step 3: Assess feasibility. This third step applies to the remaining 62 FAP candidates, and asks: How complex and feasible would it be to innovate with IAs? The goal of this step is to separate those functions that current IA technology could reasonably automate from those with future potential. (We will of course wish to automate first those tasks for which we can write code today, and to defer those that are as yet beyond the capability of current IA technology.)

For example, if a function is very complex and requires a great deal of human interface, such as FAP function 28, Conferences, then it is graded with a minus (as were 30 other activities). Alternatively, if a function is routine in nature and can be easily automated, like FAP function 3, Purchase Requests, then it is graded with a plus. Only five other activities are graded plus, because such automation will be difficult (though certainly possible) to accomplish. If a function such as Market Research can be coded, but with — at present — considerable difficulty, then it is graded zero, indicating a more challenging project for the software engineer and acquisition team to complete (as were 27 others).

> "We will of course wish to automate first those tasks for which we can write code today...."

Step 4. Assess implementation risk. This final step answers the question: Does it make sense to innovate with IAs relative to the inherent risk involved? The goal of this last step is to identify the level of risk to the entire process. A good example is FAP function 78, Defective Pricing, which receives a minus, because it is very unlikely that an agent would perform such a sensitive activity without human interaction (as are 17 others). By contrast, Market Research (function 5) is graded plus, because there is limited risk involved in researching in cyberspace (as are 13 others). 32 functions are graded zero, because there is moderate risk involved (e.g., FAP function 1, Forecasting Requirements).

The results of these four steps are grouped and summarized in Table 1. It shows two clear candidates (scoring triple-plus) for IA technology: FAP function 5, Market Research, and FAP function 9, Required Sources. These two candidates both receive high grades as IA candidates, because the SPS does not currently automate these functions, there is strong potential benefit, and they represent low risk. They do not receive a perfect score of quadruple-plus, however,

FAP Function	Question 1	2	3	4	Total	Comments
Strongest Candidates (+++)						SPS does not automate
						Strong potential benefit
5. Market Research	+	+	0	+	+++	Moderately feasible
9. Required Sources	+	+	0	+	+++	Low risk
Strong Candidates (++)						SPS automates
						Strong potential benefit
6. Requirements Documents	–	+	+	+	++	Highly feasible
24. Publicizing Actions	–	+	+	+	++	Low risk
7. Use of Sources	0	+	0	+	++	SPS does not automate
18. Recurring Requirements	0	+	0	+	++	Strong potential benefit
35. Processing Proposals	0	+	0	+	++	Moderately feasible
43. Communications/ Fact-finding	0	+	0	+	++	Low risk
66. Past Performance	0	+	0	+	++	
Moderate Candidates (+)						SPS only supports
						Strong potential benefit
4. Funding	0	+	0	0	+	Moderate feasible
23. Procurement Planning	0	+	0	0	+	Moderate risk
36. Non-Price Factors	+	+	–	0	+	SPS does not automate
41. Evaluating Other Offered Terms	+	+	–	0	+	Strong potential benefit
46. Conducting Discussions/						Not very feasible
Negotiations	+	+	–	0	+	Moderate risk
						SPS supports
60. Task & Delivery Order	0	0	+	0	+	Moderate potential benefit
79. Property Administration	0	0	+	0	+	Highly feasible
82. Claims	0	0	+	0	+	Moderate risk

Table 1. Assessment Summary

because the task of programming and developing such IA functions is only moderately feasible. Nonetheless, they are the strongest candidates.

The second group (FAP functions 6, 24, 7, 18, 35, 43 and 66) comprises seven strong candidates (e.g., graded double plus) that represent the next best set of candidates. The third, lowest-potential group (i.e., FAP function 4, 23, 36, 41, 46, 60, 79 and 82) comprises eight moderate candidates (e.g., graded plus), for which development of IAs should be deferred until after first addressing groups having higher potential.

PROTOTYPE THE NEW PROCESS

Davenport suggests the final area to be addressed through innovation analysis is to propose a prototype design of the new process. Toward this end, we outline innovative process redesigns based on the two strongest candidates for IAs — market research and required sources — and leave the candidates with less potential for future consideration.

Market research. The first acquisition function to automate through IAs involves external market research. Multiple agents can be employed to function outside of the SPS via electronic means on the Internet. Specifically, this redesign calls for agents to perform two specific market research tasks, market investigation and exchanges prior to soliciting (Federal Acquisition Process, 1998). The greatest outcome lies not only in the fact that these functions can be automated through IA technology (e.g., effect considerable savings in terms of cost and cycle time), but more information can be shared and used as well. Moreover, instantaneous and continuous access to this type of data collection and manipulation should promote competition and better prices.

Consider first market investigation. Suppose we require a computer monitor. One agent is sent out to identify prices in a specific electronic catalog (e.g., GSA Advantage). Another agent is sent to do the same in another catalog (e.g., a national commercial franchise). These agents are tasked to retrieve the data and report back to the acquisition professional on a periodic and specified basis, tailored to the user's needs and desires. Similar agents are tasked to continually monitor other catalogs and Web sites and report to the user whenever items of interest are added or the prices are modified. Still other agents filter and periodically report all of the CBD announcements for related computer monitor acquisition actions, and such agents can collaborate to compare and obtain best prices and products.

> "The first acquisition function to automate through IAs involves external market research."

More advanced performative agents (e.g., the Intelligent Mall; see Nissen, 2001) go out to our supply-chain vendors, communicate requirements, and inform us of all potential suppliers. These "data mining" agents interface with the SDW, which could include sites that host commercial specifications and standards, laws, past performance, patents, small businesses, federal sources, government contract files, vendor contract files, *Consumer Reports*, telephone directories, the *Thomas Register,* trade journals, news media, commodity indices and others.

Next consider exchanges prior to solicitation. Agents are similarly tasked to search, filter, and retrieve data, and to perform advanced functions outside of the SPS. Agents automate the majority of routine functions like sending out requests for information, notices, establishing industry panels, and conducting basic exchanges. This innovation also addresses internal market research; that is, the agents perform and interface within the local SPS network.

"The next generations of IT, incorporating IA technologies, offer the potential to dramatically reduce acquisition cost and cycle time."

Further, one agent could collect all the in-house data regarding historic and current contracts, similar to the external agents described above. Another agent could collect the external data and format it into comprehensive reports, estimate price and total acquisition cost, publicize the method of exchanges, send out exchanges of information, issue an RFP or RFQ, request feedback, draft pre-solicitation notices, and conduct (virtual) pre-solicitation conferences. Clearly, acquisition process performance gains in terms of reduced cost and cycle time would be tremendous.

Required sources. The second IA-enabled innovation involves checking the availability of external required sources. Many aspects of the FAP function 9, Required Sources, are very similar to those of market research, except this function is more defined and regulated to specific sources of supply. Agents can deploy to required sources databases such as agency inventories, excess personal property, federal prison industries, stock programs, and other mandatory federal schedules. Similarly, there are cost and time savings associated with such automation. And more information is shared and used, promoting competition and lowering prices

The second acquisition function considers internal required sources. Internal IAs can also be used to perform this activity. For instance, select agents could prepare, purge, rotate and update source lists (such as a qualified bidder list). Other agents could search for existing contracts or agreements and even place binding orders against them. These IA functions are within the reach of information technology available today.

CONCLUSIONS AND FUTURE RESEARCH

Current IT innovations (e.g., the SPS) clearly represent a humble beginning toward advancing the state of the art in electronic contracting. The next generations of IT, incorporating IA technologies, offer the potential to dramatically reduce acquisition cost and cycle time. Our understanding of such technologies suggests other benefits as well, such as increased process quality and consistency.

The two functions ready to implement IA technology today — market research and required sources — can demonstrate the great potential benefit to be reaped from enabling agents to perform routine functions and to share vital logistic data. These candidates, as simplified models, share common external search-and-retrieval functions that can be replicated in other FAP functions, and they lay a foundation upon which other researchers can build.

For the acquisition professional and policy maker, the time to begin planning for agent-enabled process innovation is at hand. The dramatic performance gains these agents can accomplish merit investment; we should apply and integrate this advanced information technology into the FAP. The results of this investigation provide both technical and policy guidance for focusing such investment on current, high-payoff acquisition process activities and agent capabilities.

Based on this, substantial future research remains. Research is needed on alternative approaches to integrating agent technology with current and future SPS software releases. Agent technology itself requires further development, in order to demonstrate and implement additional technical capabilities (e.g., capabilities rated as only marginal at present).

Other important issues cannot be ignored. They include the need for extensive training, the need to control cost, a better understanding of specific Internet challenges such as security and compatibility, the role of risk management, the development of a detailed migration plan, and a short-term improvement plan. Failure to consider these will prolong the malaise of the past: diminished productivity due to the automation of an inefficient, one-size-fits-all process.

Finally, acquisition professionals and policy makers must begin planning for electronic contracting in this new, agent-enabled environment. Further research can help such professionals and policy makers better visualize and prepare for the ensuing next generation of electronic contracting. The research described here is a first step toward this end.

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